Amendments to the Drawings

The attached sheets of drawings in clue changes to Figures 1 and 2. These sheets replace the original sheets. In Figures 1 and 2, the spellings of "Voltage" and "Time" have been corrected.

REMARKS

The Office Action dated March 15, 2006 has been received and carefully studied.

The Examiner objects to Figures 1 and 2 and suggests correcting language. Submitted here with are amended drawings with the corrections.

The Examiner rejects claims 1-26 under 35 U.S.C. §112, second paragraph, as being indefinite for various reasons. The Examiner states that claims 1 and 15 are unclear as to whether the cathode includes all or at least one of the various additives listed. By the accompanying amendment, claims 1 and 15 have been amended to clarify the language.

Regarding claims 9 and 23, the Examiner questions the meaning of "the total anticipated portion" and "the specific inorganic crystalline additives". By the accompanying amendment, the term "anticipated" as been deleted, and the inorganic additives disclosed in claims 2-8 have been specifically incorporated into these claims. It is believed that the amendment overcomes the rejection.

Regarding claims 10, 11 and 24, the language objected to has been removed.

The Examiner objects to claim 15 under 37 C.F.R. 1.75(c) as being improper for failing to further limit the claim on which it depends. Claim 1 is directed to an

electrochemical cell having a cathode, and claim 15 is directed to the cathode for an electrochemical cell. By the accompanying amendment, claim 15 has been amended to further be an independent claim directed to a cathode.

The Examiner objects to claims 16-25 as improper multiple dependent claims, since a multiple dependent claim must refer to other claims in the alternative. By the accompanying amendment, the improper terminology has been eliminated.

The Examiner rejects claims 1 and 9-15 under 35 U.S.C. §103(a) as being unpatentable over Davis et al., U.S. Patent No. 5,532,085. The Examiner states that Davis et al. disclose an electrochemical cell containing an anode, a separator and a cathode composed of manganese dioxide and incorporating an inorganic crystalline additive of tungsten oxide in the proportions claimed.

By the accompanying amendment, claim 1 has been amended to recite a group of additives wherein the tungstenates are specifically recited. Davis discloses only $CaWO_4$. This compound has a scheelite type structure (data collected in the Inorganic Crystal Structure Database, ICSD, #60547; Tetragonal $14_1/a$; $a_1b=5.24$, $c=11.38$). In contrast, the instant claims as amended recite $BaWO_4$, Na_2WO_4, $SrWO_4$ and ($MnWO_4$). Two chemical compounds with similar formulas are

not necessarily similar and haven't similar characteristics (and do not exhibit similar behavior as additives). For example, the characteristics of the minerals mainly composed of $CaWO_4$ (Scheelite) and $MnWO_4$ (Hubnerite) can be compared in www.webmineral.com/data/Scheelite.shtml and www.webmineral/com/data/Hubernite.shtml, respectively.

In the chemical and natural world, many examples can be found of compounds with the same chemical formula and completely different chemical and physical properties. This divergence in properties is due to different crystal structures that are possible for the same chemical composition, called polymorphs. A typical example is SiO_2, with structures such as quartz, tridymite and crystolballite showing different properties. The phenomenon is also referred to as isomerism in molecular compounds (ex., C_3H_8O, 3 structures: propan-1-ol, propan-2-ol and methyl ethyl ether; ex. L- and D-amino acids) and allotrophy for elements (ex. C, graphite and diamond).

Sodium tungstenate (Na_2WO_4) and manganese (II) tungstenate ($MnWO_4$) present a crystal structure completely different from that of $CaWO_4$. Sodium tungstenate has a cubic spinel structure (ICSD #2133; Fd3m; a,b,c=9.133) and manganese (II) tungstenate is a monoclinic huebnerite (ICSD #67906; P2/c; a=4.83, b=5.76, c=4.99, β=91.14). This

significant difference in crystal structure gives rise to different properties and behavior, thus setting apart these additives from the one stated in the Davis patent.

The other two additives, strontium tungstenate ($SrWO_4$) (ICSD #23701; $I4_1/a$; a,b=5.42, c=11.95) and ($BaWO_4$) (ICSD #23702; $I4_1/a$; a,b=5.61, c=12.72) have the same scheelite structure of $CaWO_4$. This is usual for compounds where the change is between elements of the same group of the periodic table, due to similar electronic configuration of the valence band. However, the atomic number and therefore electronegativity and size of the cation are different for Ca^{2+}, Sr^{2+} and Ba^{2+}, affecting the environment and bonds of the electrochemically active W atoms. A good example of differing properties for the same structure involving these elements is the widely known ferroelectric $BaTiO_3$ vs. $CaTiO_3$ and $SrTiO_3$. The three of them present a perovskite structure but the higher size of Barium [ionic radii (8Å): 1.47 (Ba^{2+}), 1.31 (Sr^{2+}), 1.18 (Ca^{2+})] distorts more significantly the Ti-O bond, lowering the HOMO-LUMO gap and favoring polarization conductive to high ferroelectricity. The size of Ca and Sr, however, fits without distorting the environment. Hence these compounds, despite the chemical similarity, are only normal dielectrics while $BaTiO_3$ is used as a capacitor in electronic circuits, for example. This illustrates the

great differences existing when choosing one element or another to form a compound.

A change in element composition and/or structure having a great impact on the properties is a widely studied issue in Chemistry and Materials Science. Many examples are presented in fundamental reference books, such as:

- R. Chang, Chemistry, 6th Ed., McGraw Hill 1998
- P.A. Cox, The Electronic Structure and Chemistry of Solids, Oxford University Press, 1987
- F.A. Cotton, G, Wilkinson, Inorganic Chemistry, 4th Ed., Wiley & Sons, 1980
- A.F. Wells, Structural Inorganic Chemistry, 5th Ed., Oxford University Press, 1984
- A.R. West, Basic Solid State Chemistry, 6th Ed., Wiley & Sons, 1999.

Accordingly, one skilled in the art would have no reasonable expectation of success in using the instant additives in place of the tungsten oxide disclosed by Davis.

Reconsideration and allowance are respectfully requested in view of the foregoing.

Respectfully submitted,

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